

toward a minimum of vapor near the time of maximum temperature, especially during the warmer months of the year, but the question is much complicated by evaporation and variations in wind velocity and direction, so that the afternoon minimum is often reduced, obliterated, or even turned into a maximum.

The only thing that could cause an actual decrease in the total amount of vapor in the air during the middle of the day is cloudy condensation, which is most active at that time. But this would be a very small factor.

Vapor pressure normally decreases with increase in altitude rather rapidly. (MONTHLY WEATHER REVIEW, March, 1919, p. 160.) During the heated portion of the day, especially in the warmer months, convection is quite active, and results in mixing the surface air with the drier air above. This mixing also brings down with the air from above, some of the momentum of the upper-air currents, and results in higher wind velocity during the day, and a turbulence of the atmosphere. This mixing by convection and turbulence is probably the true reason for the depression of the vapor pressure in the middle of the day. Observations aloft would probably show a rise in vapor pressure in the middle of the day, just as the wind velocity aloft is diminished thereby.

INTENSE RAINFALL AT DUBUQUE, IOWA, JULY 9, 1919.

Mr. J. H. Spencer, meteorologist, in charge of the Dubuque Weather Bureau office, has sent us an account of a very intense rainfall which accompanied a local thunderstorm July 9, 1919. In spite of the intensity of the rainfall, "thunder and lightning were rather less severe than in some of the storms of the past eight years," and the wind velocity was light.

"At no time during the hours that preceded the period of heaviest rainfall was there much indication of a severe storm, although the weather in the morning quickly changed to warm and sultry. Rain began as a light thundershower from 10:25 a. m. to 10:55 a. m. (ninetieth meridian time). Rain began again at 11:15 a. m. and was moderately heavy until 1:50 p. m. (the total to this time exceeding 1 inch). Then followed the great downpour of 2.64 inches in 45 minutes from 1:51 p. m. to 2:36 p. m.

"The following table gives the heaviest rainfall in periods of 5 minutes, 10 minutes, 15 minutes, 30 minutes, 1 hour, 2 hours, and 24 hours. It shows how much heavier was the rainfall on July 9, 1919, within a 1-hour period, than during any storm at Dubuque in recent years:"

Storm of—	5 min- utes.	10 min- utes.	15 min- utes.	30 min- utes.	1 hour.	2 hours.	24 hours.
July 4-5, 1876.....						1 4.55	4.55
Aug. 10-11, 1911.....	0.32	0.52	0.62	0.81	1.12	1.97	3.75
Aug. 18-19, 1912.....	.50	.71	.84	1.46	1.95	2.62	5.23
Aug. 31-Sept. 1, 1914.....	.41	.72	1.03	1.30	1.68	1.96	3.18
Sept. 14-15, 1914.....	.34	.51	.58	.73	.85	1.20	3.36
Sept. 25-26, 1915.....	.34	.46	.53	.68	1.27	2.23	4.79
Aug. 16-17, 1918.....	.35	.62	.79	1.37	2.10	2.90	5.22
July 9, 1919.....	.80	1.20	1.52	2.23	2.70	3.03	3.87

¹ 2 hours 5 minutes. 40 persons were drowned as the result of this storm.

Figure 1 shows the intense rainfall of July 9, 1919 (dotted line), in relation to other excessive rates in the North Central States plotted by Prof. A. N. Talbot.¹

¹ Rates of maximum rainfall, Technograph No. 6, University of Illinois, 1892, 15 pp., incl. 8 diagrams.

The dashed curve A represents rates of rainfall which are rarely exceeded in the eastern United States. Its equation is $y = 6.0/(x + .5)$, where y is the rate of rainfall in inches per hour for the time x expressed in hours. Curve B expresses the rate of frequent occurrence: $y = 1.75/(x + .25)$.

"It is worthy of note that at Dubuque during the past nine years (1911 to 1919, inclusive) there have been seven storms in which more than 3 inches of rain within 24 consecutive hours fell, or more storms of similar intensity than occurred during the 29-year period from 1882 to 1910, inclusive, which gave only six. On the other hand, during the eight-year period from 1874 to 1881, inclusive, there were nine storms that gave more than 3 inches of rain within 24 consecutive hours."

An account of the seven lives lost and the \$125,000 damage by the freshet resulting from this excessive rainfall will be found below on page 506 in the river and flood section.—C. F. B.

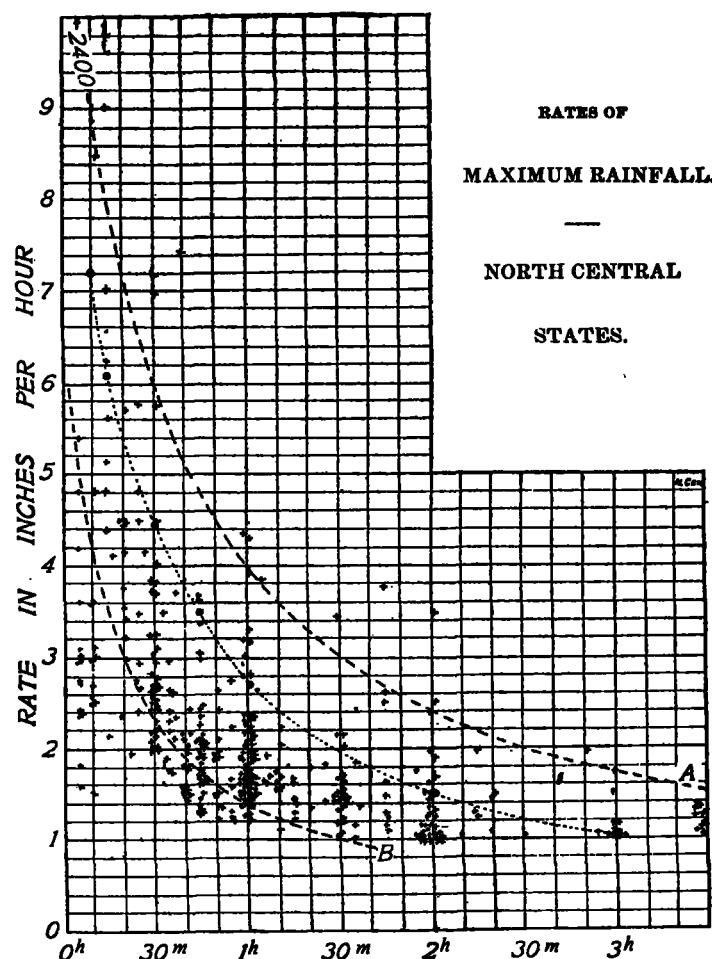


FIG. 1.—Excessive rainfall at Dubuque, Iowa, July 9, 1919, dotted line, compared with other excessive rates in North Central States. Compiled by A. N. Talbot.

HEAVY RAINS AT TAMPICO, MEXICO, JUNE 29-JULY 5, 1919.

By S. A. GROGAN.

[Dated Tampico, Tamaulipas, Mexico, July 7, 1919.]

During the week of June 29 to July 5, inclusive, more rain fell at Tampico than during the entire first six months of the year. From 6:30 a. m. on the 29th to 6:30 a. m. on the 5th a total precipitation of 15.64